# SECTION 7

# DATA REDUCTION, VALIDATION AND REPORTING

## 7.1 LABORATORY PROCEDURES

### 7.1.1 Data Reduction

7.1.1.1 The procedures used for calculations and data reduction are specified in each laboratory analytical method referenced in Section 6. Calculations required to arrive at the final (reported) value for each sample include factors such as sample dilution ratios and conversion to dry-weight basis for solid samples. Calculations for precision, accuracy, and completeness are presented below.

7.1.1.2 Data will be reported in the units listed in Table A.1. Concentration units are to be listed on reports and any special conditions, such as dry weight conversions will be noted. Target analyte values detected and reported below the MQL must be flagged as an estimated quantity (i.e., J-flag). Soil/sediment Results should be reported on a dry weight basis. "Non-detects" should be reported as less than the quantitation limit.

### 7.1.2 Precision

Precision of laboratory analysis will be assessed by comparing the analytical results between matrix spike/matrix spike duplicate, field duplicate, and laboratory duplicate analyses. The relative percent difference (%RPD) will be calculated for each pair of duplicate analysis using the following equation:

$$\text{Percent RPD} = [(S-D)/(S+D)/2]\times 100$$

Where:

S = First sample value (original value)

D = Second sample value (duplicate value)

### 7.1.3 Accuracy

Accuracy of laboratory results will be assessed for compliance with the established QC criteria that are described in this document and in the specific methods using the analytical results of method blanks, reagent/preparation blank, matrix spike samples, laboratory spikes, and rinsate blanks. The percent recovery (%R) of samples will be calculated using the following:

$$\text{Percent R} = [(A-B)/C]\times 100$$

where,

A = The analyte concentration determined experimentally from the spiked sample;

B = The background level determined by a separate analysis of the unspiked sample; and

C = The amount of the spike added.

### 7.1.4 Completeness

7.1.4.1 Field completeness will be estimated as the percentage of all planned samples that were actually collected and analyzed. The calculation is as follows:

$$\% \text{ Field Completeness} = (A/P) \times 100$$

where,

%FC = Field Percent Completeness;

A = Actual number of samples collected; and

P = Number of planned samples to collect.

7.1.4.2 Laboratory completeness will be estimated as the percentage of all usable measurements and calculated as follows:

$$\%C = (U/T) \times 100$$

where:

%C = Percent completeness;

U = Number of measurements judged usable; and

T = Total number of measurements.

7.1.4.3 Deviations from the completeness criteria will be discussed and addressed after consultation with USACE and DNSC on a project-specific basis.

### 7.1.5 Sensitivity

The achievement of method detection limits depends on instrument sensitivity and matrix effects. Therefore, it is important to monitor the instrument sensitivity to ensure the data quality through constant instrument performance. The instrument sensitivity will be monitored through the analysis of method blanks and calibration check samples.

### 7.1.6 Data Verification

7.1.6.1 All analytical data will be verified prior to being released by the laboratory. Laboratory data verification will consist of reviewing the data for both editorial and technical validity. The editorial review consists of a check for typographical, transpositional and omissional errors. This review also includes a proofreading of any text which may accompany the data. The technical review consists of a check to see that all precision, accuracy and detection limits have been met.

7.1.6.2. The following flags will be used by the laboratory when reporting results of organic analyses:

E Identifies compounds whose concentrations exceed the upper level of the calibration range of the instrument for that specific analysis.

J This flag indicates an estimated value concerning either, (1) estimating a concentration for tentatively identified compounds (TICs), or (2) analyte detected at a level less than the RDL or PQL and greater than or equal to the MDL.

N Presumptive evidence based upon a mass spectral library search to make a tentative identification of the analyte.

NJ Analyte has been tentatively identified and the associated numerical value is estimated based upon 1:1 response factor to the nearest eluting internal standard.

P - Pesticide/PCB target analyte that is greater than 25% difference for the detected concentrations between the two GC columns.

- HPLC target analyte that is greater than 40% difference for the detected concentrations between detectors or columns.

U Compound analyzed for but not detected (sample quantitation limit has been adjusted to reflect dilutions and percent moisture).

X Other reporting flag as defined in report narrative.

** Laboratory Control Sample recovery outside of acceptance limit.

Data qualifiers (flags) for inorganic analyses are as follows:

E The qualifier that is used when the percent difference between the parent sample and its serial dilution's concentration exceeds 10%. The sample's concentration must be greater than 50 times the IDL/MDL for ICP or 100 times the absolute value of the preparation blank's concentration for ICP-MS. However, if analyzing ILMO 4.0 (ICP-MS), the parent sample's concentration must be 20 times the CRDL before the "E" flag is applied.

* The qualifier that is used to indicate the duplicate sample analysis for an analyte is out of control.

B The qualifier is used to indicate that the reported result fell above the IDL/MDL but below the CRDL.

N This qualifier is used to indicate that the matrix or pre-digested spike sample recovery for an analyte is not within the specified control limit.

U Analyte analyzed for but not detected above the PQL/CRDL.

X Other reporting flag as defined in report narrative.

** Laboratory Control Sample (LCS) recovery for an analyte is outside of specified acceptance limit.

### 7.1.7 Data Reporting

7.1.7.1 Definitive data packages will meet the requirements of EM 200-1-3 in the absence of any state-specific program requirements, or project-specific requirements as described in the site-specific work plan addendum. As a minimum, the laboratory report will show traceability to sample analyzed, and will contain the following information:

- Name of report;
- Date of report preparation;
- Laboratory name, address, and telephone number;
- Sample I.D. number;
- Name of sample;
- Type of sample (water, soil, etc.);
- Analyses performed;
- Initial sample volume for analysis;
- Final sample volume (after extraction) for analysis;
- Type of extraction performed (including method number);
- Date of sampling;
- Date sample was received;
- Date extractions/analyses were performed;
- Applicable laboratory blank results;
- Sample detection limits for each compound;
- Quality control check sample summaries including amount spiked, amount found in unspiked sample, percent recoveries and relative percent differences between the two percent recoveries;
- Calibration and instrument tuning performance summaries;
- All supporting raw data.

7.1.7.2 Project name and I.D. number will appear on the Chain of Custody Record. A copy of the completed COC records and cooler receipt forms for all shipments of samples will be maintained in the laboratory project file. The laboratory will also archive all logbooks associated with the sample management procedures. These records will be filed accordingly, so they will be easily retrievable in the future, if needed. The laboratory turnaround will be 30 days for the EDD and paper copy, unless otherwise specified in the subcontract agreement. All raw data will be retained by the laboratory for a minimum of seven years in a manner such that, data can be easily retrieved upon request.

7.1.7.3 The laboratory will submit the analytical data for environmental, field and laboratory QC samples on diskettes or CD-ROM. The electronic data delivery (EDD) shall contain the same information as described for the hard copy deliverable. In general, the EDD submittal will be in the CEHNC DLA Environmental Data Management System (EDMS) format and include:

- the laboratory's identification of each field sample,
- field sample identifications,
- analytes,
- results,
- data qualifiers and validation flags,
- concentration units, and
- applicable QC data.

## 7.2 DATA ASSESSMENT

As described in the project-specific work plan, analytical data will be validated by the Project Chemist at Parsons. The precision, accuracy, and completeness of measurement data generated during the investigation will be assessed. This is made possible by the inclusion of QC procedures and samples in the data collection process.

### 7.2.1 Field Measurements

Accuracy of the field measurements will be assessed using daily instrument calibrations, calibration checks, and analysis of blanks. Precision will be assessed on the basis of reproducibility by multiple reading of a single sample.

### 7.2.2 Laboratory Data Validation

7.2.2.1 Data validation for laboratory data will be performed for all sample results in accordance with the requirements contained in the SAP, EM 200-1-3, applicable USEPA Region SOPs, and the USEPA *National Functional Guidelines for Data Review* (USEPA, 1999, 2002) by the Parsons' QA Manager. The specific information for any applicable USEPA Region Guidance will be included in the site-specific addenda. Laboratory results will be assessed for compliance with required precision, accuracy, completeness and sensitivity. Field QC results

will be evaluated for compliance with required precision, accuracy, and representativeness. At a minimum, the review of laboratory data will focus on the following subjects:

- COC forms,
- Holding times,
- Method calibration limits,
- Method blanks,
- Laboratory-established detection limits,
- Analytical batch control records including spike recoveries and spike duplicate results,
- Surrogate standard recoveries, if applicable,
- Internal standard areas and RTs, if applicable,
- Corrective actions,
- Formulas used for analyte quantitation,
- Calculations supporting analyte quantitation, and
- Completeness of data.

7.2.2.2 Data outliers that fall outside of the QC criteria outlined in this SAP, the site-specific addenda, or in the applicable USEPA or SW-846 methods will be flagged with an appropriate qualifier that is descriptive of the outlying condition (i.e., precision limits exceeded, etc.). Data will be flagged both in laboratory reports as well as during the data validation process. All data validation flags applied will be added to the EDD prior to submittal.

7.2.2.3 The following definitions provide explanations of the qualifiers to be assigned to analytical results by the data validators. If additional qualifiers are used, a complete explanation of those qualifiers will accompany the data review.

**Organic and Inorganic Data Validation Qualifiers**

**U** - The analyte was analyzed and is not present above the level of the associated value. The associated numerical value indicates the approximate concentration necessary to detect the analyte in this sample (e.g., the project reporting level).

**J** - The analyte was analyzed for and was positively identified but the associated numerical value may not be consistent with the amount actually present in the environmental sample. The data should be seriously considered for decision-making and are usable for many purposes.

**R** - The data are unusable for all purposes. The analyte was analyzed but the presence or absence of the analyte has not been verified. Resampling and reanalysis are necessary to confirm or deny the presence of the analyte.

**UJ** - A combination of the "U" and "J" qualifiers. The analyte analyzed was not present above the level of the associated value. The associated numerical value may not

accurately or precisely represent the concentration necessary to detect the analyte in the sample.

## 7.3 PERFORMANCE SYSTEM AUDITS

The laboratory QA officer will carry out performance and/or systems audits to insure that data of known and defensible quality are produced during the program. The laboratory shall maintain USACE certification. All GEL certification information is included in Appendix A. If a laboratory other than GEL is required, all applicable certifications will be included in the site-specific addenda. GEL is USACE-Certified indicating that they have met the minimum requirements to perform analyses on USACE project samples. The current USACE validation was granted on February 8, 2002 and will expire February 8, 2004. In addition, the laboratory participates in the National Environmental Laboratory Accreditation Program (NELAP). As members of this program, the laboratory undergoes periodic audits and must perform satisfactorily on Proficiency Testing samples. The current NELAP certification for GEL was granted on July 1, 2003 and expires June 30, 2004.

### 7.3.1 System Audits

Systems audits are qualitative evaluations of components of the laboratory quality control measure systems. They determine if the measurement systems are being used appropriately. The audits may be carried out before all systems are operational, during the laboratory program, or after the completion of the laboratory program. Such audits typically involve a comparison of the activities given in the QA/QC Plan with activities actually scheduled or performed. A special type of systems audit is the data management audit. This audit addresses only data collection and management activities.

### 7.3.2 Performance Audits

7.3.2.1 The performance audit is a quantitative evaluation of the measurement systems of a program. It requires testing the measurement systems with samples of known composition or behavior to evaluate precision and accuracy. The performance audit is carried out by or under the auspices of the laboratory QA Officer without the knowledge of the analyst.

7.3.2.2 The laboratory QA Officer is responsible for evaluating the accuracy and precision of the analytical data. Based on this evaluation, the laboratory QA Officer will implement corrective actions as necessary to ensure that reliable data is obtained.

### 7.3.3 External Audit

The Project QA/QC Officer may perform at least one complete sample handling, analysis, and laboratory procedures audit apart from the normal audits performed by the laboratory QA Officer prior to, during, or subsequent to the field activities. The laboratory will be using methods as specified in Section 6.

## 7.4 PREVENTATIVE MAINTENANCE

All field equipment, instruments, tools, gauges and other items requiring preventative maintenance will be serviced in accordance with the manufacturer's specified recommendations. The laboratory instruments will be maintained as specified in the laboratory's Quality Assurance Manual. Maintenance records will be documented and traceable to specific equipment at the laboratory.

## 7.5 CORRECTIVE ACTION

The Parsons Field Team Leader, Project Manager, and Chemist shall be responsible for implementing corrective actions for the fieldwork. The laboratory QA Officer shall be responsible for implementing laboratory corrective actions. The need for corrective actions, if any, shall be determined by periodic audits as previously discussed. The corrective actions implemented, if any, shall be documented in the field logbook or laboratory files, as applicable. The Parsons Field Team Leader, Project Manager, and Chemist shall be responsible for assessing the data against project DQOs. The analytical sample data will be compiled on spreadsheets and compared to the criteria on Tables 3.2 and A.1, to ensure these DQOs were met. The data will then be compared to the applicable regulatory criteria (i.e. state or federal remedial action or clean up criteria, groundwater standards, etc.) to ensure analytical detection limits are at or below the regulatory criteria. If DQOs are not met or are compromised, the corrective action will be discussed between USACE, DNSC and Parsons to determine an appropriate course of action, based on the project-specific considerations.

## 7.6 QC REPORTS

The Task Order Manager will receive reports on the performance of the data quality at the completion of the data validation process from the Project Chemist. These reports will at least include:

- Assessment of measurement quality indicators, i.e., data accuracy, precision and completeness;
- Significant QC problems and any impact to the data quality.

These reports will be included, in part or whole, in the site-specific reports. Any instance of rejected data will be brought to the attention of the Project Manager and the site-specific Task Order Manager as soon as it is detected.

# SECTION 8

# REFERENCES

USACE, 1998. EM 200-1-2, "Technical Project Planning Process." United States Army Corps of Engineers Engineering Manual, EM 200-1-2.

USACE, 2001. "Requirements for the Preparation of Sampling and Analysis Plans." United States Army Corps of Engineers, Engineer Manual 200-1-3.

USEPA, 1992. "Guidance for Performing Site Inspections Under CERCLA, Interim Final." Office of Solid Waste and Emergency Response. EPA/540-R-92-01. September 1992.

USEPA, 1999. "National Functional Guidelines for Organic Data Review." USEPA Contract Laboratory Program, EPA-540/R-99-008. October 1999.

USEPA, 2000. "Data Quality Objectives Process for Hazardous Waste Site Investigations." Office of Environmental Information. EPA/600/R-00/007. January 2000.

USEPA, 2002. "National Functional Guidelines for Inorganic Data Review." USEPA Contract Laboratory Program. EPA 540-R-01-008. July 2002.